

North of the Delta
Offstream Storage Investigation

Progress Report

Appendix I: Road Relocation Studies

August 2000

Integrated
Storage
Investigations

CALFED
BAY-DELTA
PROGRAM

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Appendix I: Road Relocation Studies

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Northern District
California Department of Water Resources

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Introduction

This report identifies roads that would be inundated by the Sites, Colusa, or Thomes-Newville Project Reservoirs (see Figure 1), and suggests potential alternative road relocation alignments. Transportation will still be needed around a new reservoir, so alternative road alignments are being considered. For Sites or Colusa Reservoirs, existing road access would have to be maintained from Maxwell to Lodoga, and for a Newville Reservoir, access would be needed around the reservoir on the southeast, northeast, and northwest sides.

Residents who commute from Lodoga to communities east of Sites Reservoir travel daily through the proposed Sites Reservoir area. Also, vacationers travel this route to get to East Park Reservoir from Interstate 5. If any of the projects are constructed the sponsor has an obligation to replace roads or provide alternate access from roads owned by individuals, counties, or other agencies.

Project Description

Sites Reservoir would be a 1.2 to 1.8 million acre-foot reservoir, located eight miles west of Maxwell. This reservoir could be expanded to the north, resulting in the 3.0 million acre-foot Colusa Reservoir. Newville Reservoir would be a 1.9 to 3.0 million acre-foot reservoir, located 18 miles west of Orland.

Inundated Roads

Both the Sites and Colusa Reservoirs would inundate portions of the Maxwell-Sites Road and the Sites-Lodoga Road, blocking travel between Maxwell and Lodoga. These roads are owned and maintained by Colusa County. About 4 miles of east-west access would be inundated. Around 6 miles of the gravel Huffmaster Road south of the town of Sites would also be inundated, although this is a private road and provides access mostly within the Sites Reservoir area. A road connecting the Maxwell-Sites Road and the area just south of Sites Reservoir would have to be constructed as part of the Sites or Colusa projects.

The Newville Reservoir site has access from the northwest and north via Round Valley Road, from the east via Newville Road and from the south via Road 306. The reservoir would flood about 2-1/2 miles of Round Valley Road, 6 miles of Garland Road, and 2 miles of Road 306. Connections between Newville Road and Round Valley Road, as well as Road 306, will have to be reestablished if the Thomes-Newville Project is constructed.

Alternative Alignments Considered

The Sites or Colusa Reservoirs would require access looping around the south or north ends of the reservoirs, as shown on Figure 2. There are two existing, alternative access routes to reach Lodoga from Maxwell (the southern teal-colored line and the northern light brown-colored line), although these take much longer to drive than the Maxwell-Sites and Sites-Lodoga roads. The first starts at Maxwell, then goes south on Interstate-5 to Highway 20 West, west on

Highway 20 to Leesville-Lodoga Road, then north to Lodoga. The other starts at Maxwell, then goes north on Interstate-5 to Willows, west on Highway 162 to Elk Creek, then south on Road 306 to Lodoga. However, several alternative road alignments were evaluated, and these alternatives could shorten the time and distance from Maxwell to Lodoga compared to the existing north and south alternative routes.

Newville Reservoir inundates 19 miles of county roads that connect the Newville, Round Valley, and Route 306 roads. These roads would have to be reconnected outside the reservoir. The topography outside the reservoir is such that alternative roads could be built fairly close to the reservoir to maintain these access connections (see Figure 4). There are no existing alternative routes short enough for consideration.

Initial Analysis of Alternatives

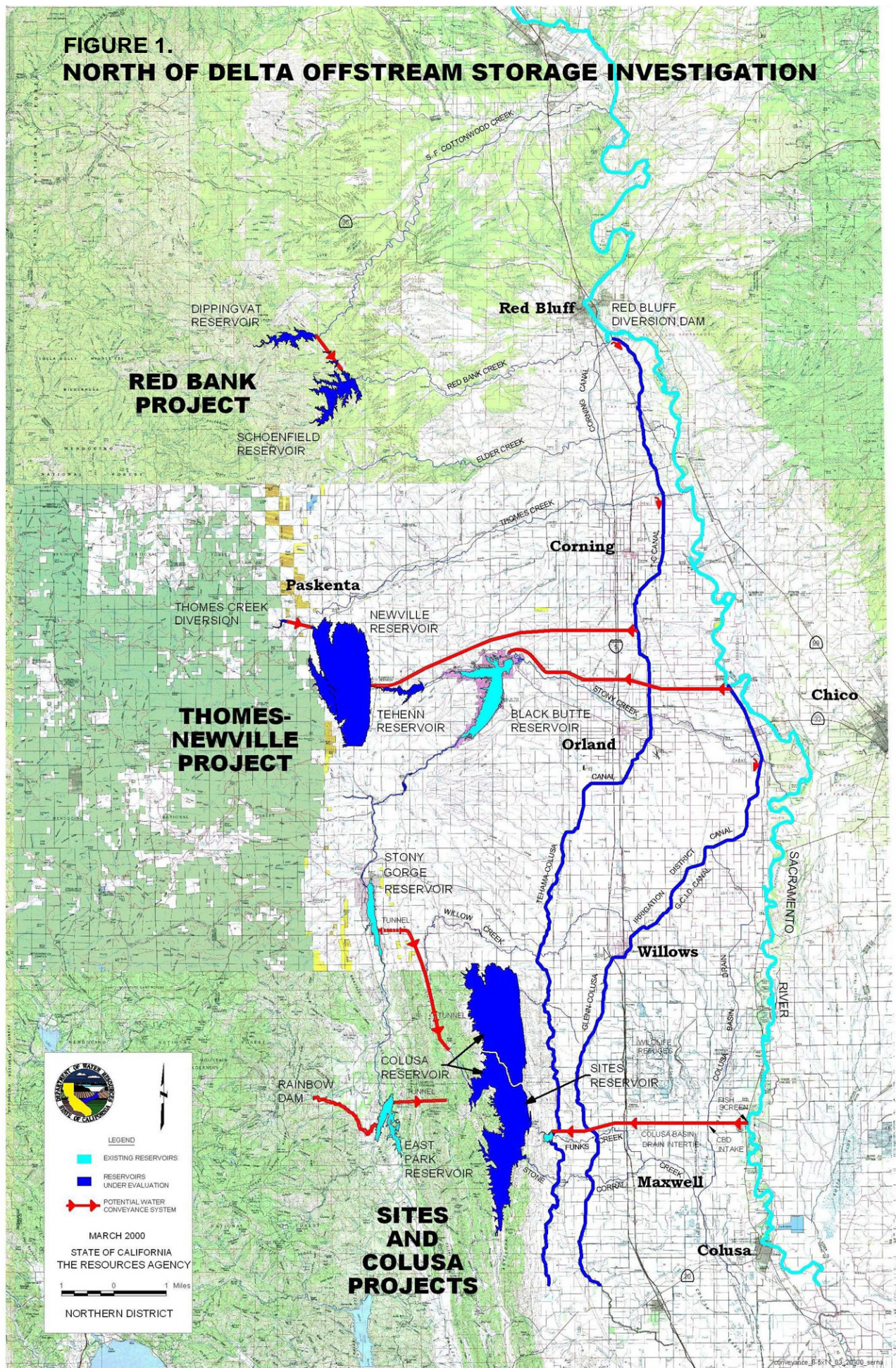
This analysis considers distances, slopes, and approximate driving times. No attempt has yet been made to determine cut and fill quantities for roads, which is the main factor in determining the cost.

Logan Ridge forms the eastern boundary of Sites or Colusa Reservoir, and it is difficult to cross except where streams run through the ridge. However, Sulphur Gap at the south end of Sites Reservoir, and the gap created by Hunters Creek at the north end, provide potential access for roads around Sites Reservoir. Therefore, the six alternative new alignments around Sites Reservoir all go through these gaps.

Colusa Reservoir would inundate the potential relocated road north of Sites Reservoir, necessitating either a new alignment farther to the north, or the southern route previously mentioned. Two alignments north of Colusa Reservoir, starting from Highway 162 west of Willows, use existing roads for most of their lengths.

Similar to Sites and Colusa Reservoirs, Rocky Ridge forms the eastern boundary of Newville Reservoir. The only convenient access through the ridge is along North Fork Stony Creek, through the Newville Dam location. Newville Road passes through the gap, providing access to Round Valley Road at the north end of the reservoir site. However, this is the main dam site for Newville Reservoir. A dam at Chrome Gap would cut off access from the south, while reservoir flooding would inundate part of Round Valley Road on the northwest side of the reservoir. Therefore, all proposed alignments bypass existing roads through the most convenient gaps.

**FIGURE 1.
NORTH OF DELTA OFFSTREAM STORAGE INVESTIGATION**



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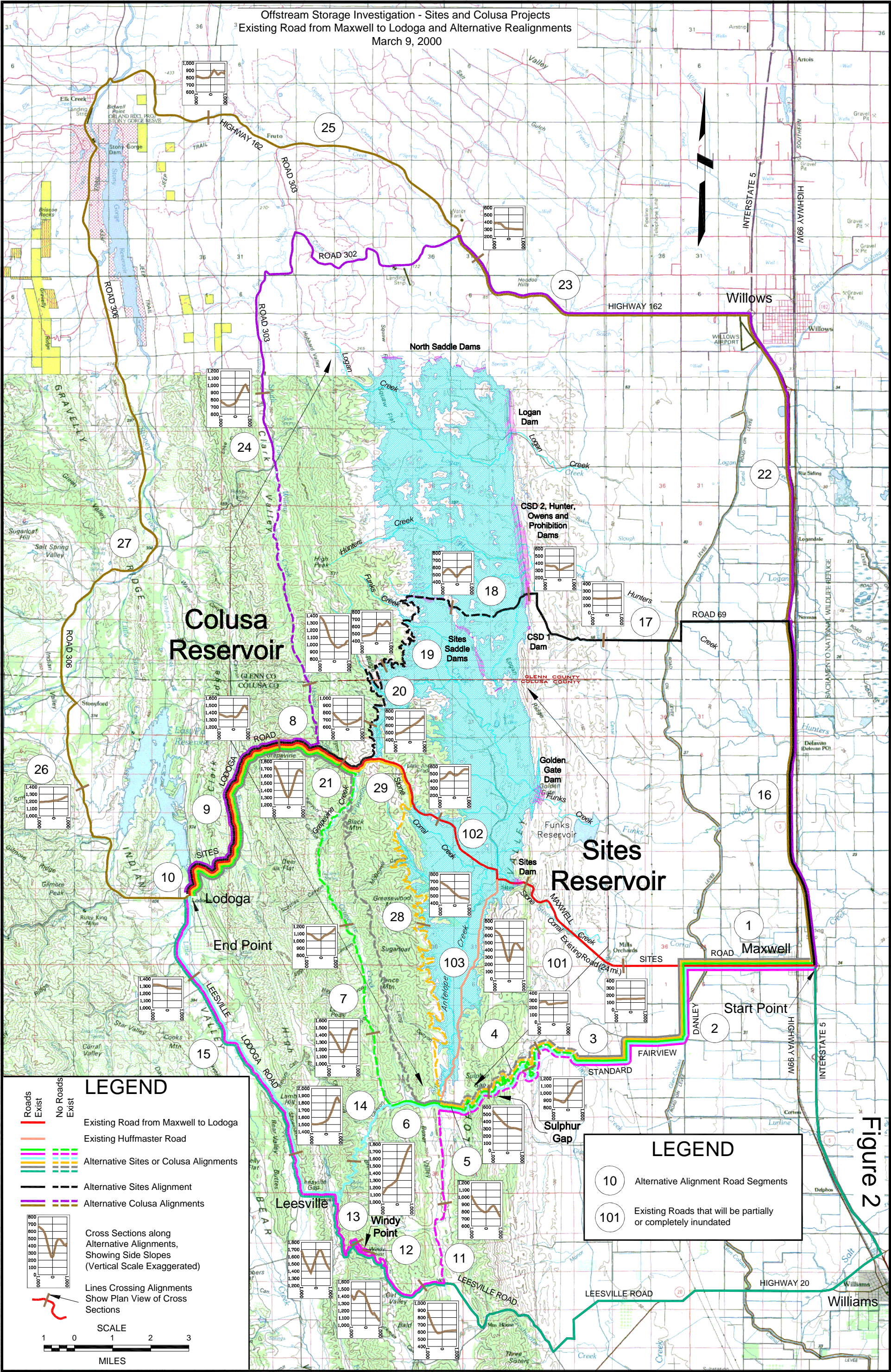
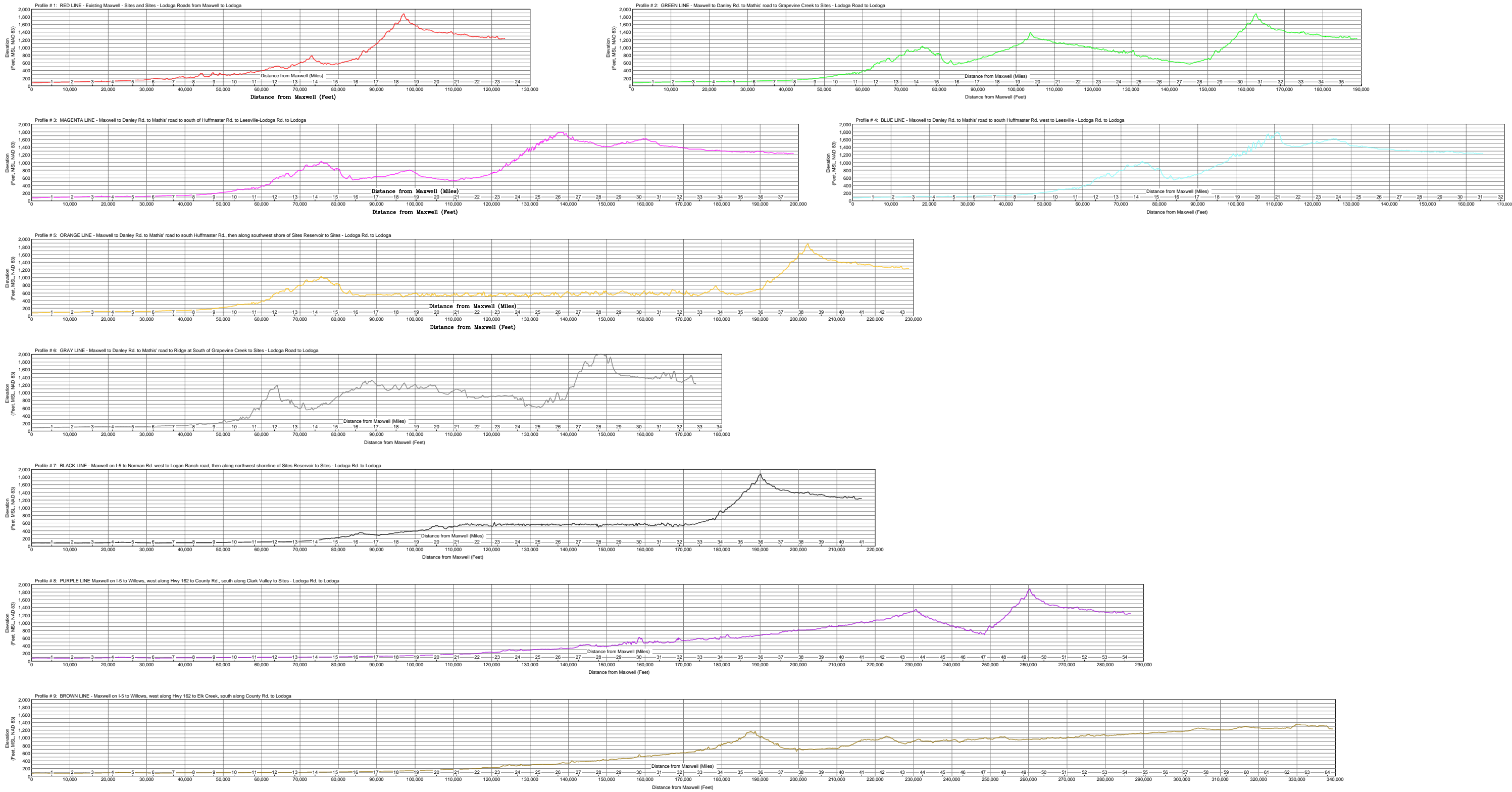


Figure 2

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Offstream Storage Investigation - Sites and Colusa Projects
Profile of Existing Maxwell to Lodoga Alignment and Alternative Realignments
March 9, 2000

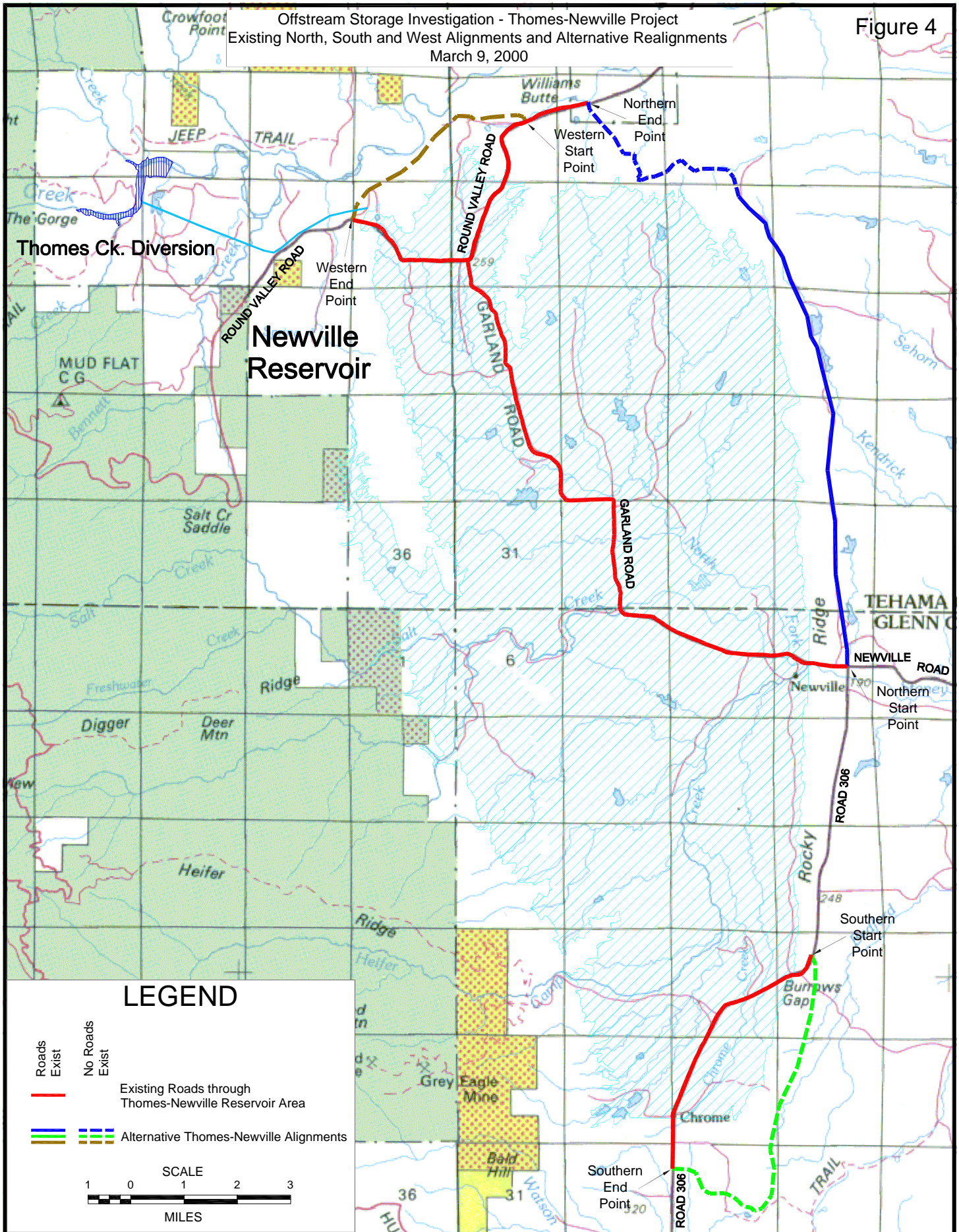
Figure 3



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Offstream Storage Investigation - Thomes-Newville Project
Existing North, South and West Alignments and Alternative Realignments
March 9, 2000

Figure 4



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In choosing new alignments, topography was the major controlling factor. State of California highway standards will be used to design new roads. The standards specify the maximum allowable profile grade (along the length of the road) as six percent. Side slopes cannot be too steep or it becomes very expensive and environmentally disruptive to cut back slopes to ensure stability. These factors tend to limit the number of new alignments. Therefore, road alignments that minimize both longitudinal and transverse slopes were chosen for routing around all three potential reservoirs. Figures 3 and 5 show the existing ground profiles of existing and proposed alignments. Figure 2 shows side slopes for the Sites and Colusa Reservoir road alignments at selected typical locations, which give an indication of the terrain.

Once the alternative alignments were chosen, the distances, average profile grades, and average horizontal curvature was estimated. Since earthwork volumes and preliminary costs have not been determined, the goal in this evaluation is to determine approximate driving times using alternative road lengths, slopes, and horizontal curvature.

Table 1 shows approximate driving times for each alternative alignment. The Sites and Colusa proposed alignments are listed in order of increasing driving time, although this is not a recommendation for any particular alignment. Note that the existing route has a much shorter driving time than the next shortest route (33 vs. 55 minutes). The Thomes-Newville proposed alignments are not listed by driving time, because there is only one alternative for each existing route.

We assumed that the average driver will go about 60 miles per hour on a flat, straight, two-lane road, and that average speed will be reduced by both the slope (longitudinal steepness) and horizontal curvature of the road. This is not a process based on standard engineering practice, but simply an empirical procedure we devised as a starting point for comparing alternatives. Since these alignments are approximate and will change, no detailed analysis has been done. These driving times are for comparison purposes and do not necessarily predict actual values. Road slope was classified low if it averaged less than two percent, moderate for slopes of two to four percent and high for slopes greater than four percent. The speed reductions used here are none for low slopes, 10 percent for moderate slopes, and 20 percent for high slopes. Horizontal curvature has a greater impact on driving speed. The speed reductions used here are none for low curvature, 30 percent for moderate curvature, and 60 percent for high curvature.

Other Tables and Figures

Tables 2 and 3 show the road segments and calculations used to determine driving times. Figure 1 is an overall project location map for Sites, Colusa, and Thomes-Newville projects. Figure 2 shows existing and alternative road relocation alignments for Sites and Colusa Reservoirs, as well as, numbered road segments used for driving time calculations. Figure 3 shows profiles of existing and alternative road alignments for Sites and Colusa Reservoirs. Figure 4 shows existing and alternative road relocation alignments for Newville Reservoir.

Figure 5 shows profiles of existing and alternative road alignments for Newville Reservoir.

Photos 1 through 8 show selected Sites Reservoir alternative alignments.

Future Work Needed

The next phase in this analysis will determine cut and fill volumes and make preliminary cost estimates for each alignment. Even some of the alignments with shorter driving times could be very expensive because of steep side slopes. For example, the Blue Line and Magenta Line alignments to the south of Sites Reservoir go through areas with several miles of side slopes in excess of two vertical feet for every horizontal foot, requiring a great amount of slope cut back and stabilization work.

Also, stream crossings must be considered. Bridges can add large costs, although all the streams except Stone Corral Creek are ephemeral and have infrequent high flows. This factor could influence the selection of the preferred alignment.

Construction and recreation access roads will be planned and designed in the next phase of this analysis. These roads will be needed along the east side of Sites or Colusa Reservoirs.

Table 1. Existing and Alternative Driving Routes for the Sites, Colusa And Thomes-Newville Projects Listed in Increasing Order of Driving Time

Line on Figure 2	Route Designation and Segment Numbers from Table 2	Route Description	Total Distance (miles)	Total Approx. Driving Time (minutes)
Sites Or Colusa Projects				
Red Line	South of Sites Reservoir 1-101-102-29-21-8-9-10	Existing I-5 at Maxwell to Lodoga	25	33
Blue Line	South of Sites Reservoir 1-2-3-4-5-6-14-15	I-5 at Maxwell to Danley to Mathis Rd. to south Huffmaster Rd. west to Leesville Lodoga Rd. to Lodoga	34	55
Black Line	North of Sites Reservoir 16-17-18-19-20-21-8-9-10	I-5 at Maxwell on I-5 to Norman Rd. west to Logan Ranch rd., then along northwest shoreline of Sites Reservoir to Sites Lodoga Rd. to Lodoga	41	56
Magenta Line	South of Sites Reservoir 1-2-3-4-5-11-12-13-15	I-5 at Maxwell to Danley to Mathis Rd. to south of Huffmaster Rd. to Leesville Lodoga Rd. to Lodoga	41	58
Green Line	South of Sites Reservoir 1-2-3-4-5-6-7-8-9-10	I-5 at Maxwell to Danley to Mathis Rd. to Grapevine Creek to Sites Lodoga Rd. to Lodoga	38	59
Gray Line	South of Sites Reservoir 1-2-3-4-5-6-Ridge East of Grapevine Creek-8-9-10	I-5 at Maxwell to Danley to Mathis Rd. to the Ridge east of Grapevine Creek to Sites Lodoga Rd. to Lodoga	> 38	> 59
Brown Line	North of Colusa Reservoir 16-22-23-25-26	I-5 at Maxwell on I-5 to Willows, west along Hwy 162 to Elk Creek, south along County Rd. 306 to Lodoga	64	64
Purple Line	North of Colusa Reservoir 16-22-23-24-9-10	I-5 at Maxwell on I-5 to Willows, west along Hwy 162 to County Rd. 303, south along Clark Valley to Sites Lodoga Rd. to Lodoga	54	68
Orange Line	South of Sites Reservoir 1-2--3-4-5-28-29-21-8-9-10	I-5 at Maxwell to Danley to Mathis Rd. to south Huffmaster Rd., then along southwest shore of Sites Reservoir to Sites Lodoga Rd. to Lodoga	46	96
Thomes-Newville Project				
Line on Figure 4				
Northern Red Line	1	North - Existing Newville Road to Garland to Round Valley Road	9	13
Southern Red Line	4	Proposed North - Newville Road to Round Valley Road	7	21
Northwestern Red Line	2	South - Existing County Road 306	3	3
Northern Blue Line	5	Proposed South - Newville Road to County Road 306	4	5
Southern Green Line	3	Northwest - Existing Round Valley Road	3	4
Northwestern Brown Line	6	Proposed Northwest - Round Valley Road to Round Valley Road	2	3

Table 2. Maxwell to Lodoga Existing and Alternative Road Realignment Segments

Road Segment	Segment Description (Refer to Figure 2)	Segment Length (miles)	Average Profile Grade ¹	Average Horizontal Curvature	Driving Speed (mph) ²	Driving Time (minutes)
1	Existing I-5 at Maxwell to 6 miles west, Maxwell Sites Rd.	6.1	low	low	60	6
2	Existing Danley and Fairview Rds.	5.3	low	moderate	40	8
3	Existing Mathis dirt rd. to Sulphur Gap	1.7	moderate	moderate	40	3
4	Existing Mathis dirt rd. to Sulphur Gap	3.2	high	high	20	10
5	Existing Mathis dirt rd. to Huffmaster Rd.	2.3	moderate	moderate	40	3
6	Existing part of dirt rd. to west of south Huffmaster Rd.	1.4	low	moderate	40	2
7	Proposed Rd. along upper Grapevine Creek	10.2	moderate	moderate	40	15
8	Existing part of Sites Lodoga Rd.	1.0	moderate	moderate	40	2
9	Existing part of Sites Lodoga Rd.	6.3	moderate	moderate	40	9
10	Sites Lodoga Rd. north of Lodoga	0.9	moderate	moderate	40	1
11	Proposed Rd. south of Huffmaster Rd., to Leesville Lodoga Rd.	7.4	low	low	60	7
12	Existing part of Leesville Lodoga Rd.	3.1	high	high	20	9
13	Existing part of Leesville Lodoga Rd.	1.3	low	low	60	1
14	Existing part of dirt rd. to west of south Huffmaster Rd., to Leesville Lodoga Rd.	4.2	high	high	20	13
15	Existing Leesville Lodoga Rd. south of Lodoga	10.2	low	low	60	10
16	Existing I-5 at Maxwell to Norman Rd.	9.1	low	low	60	9
17	Existing Norman Rd. west of I-5	8.0	low	low	60	8
18	Existing part of Logan Ranch dirt rd.	3.8	moderate	moderate	40	6
19	Proposed part of road along northwest Sites Reservoir shore	2.4	moderate	high	20	7
20	Proposed part of road along northwest Sites Reservoir shoreline to Sites Lodoga Rd.	9.0	moderate	moderate	40	14
21	Existing part of Sites Lodoga Rd.	0.4	moderate	low	55	0
22	Existing I-5 Norman Rd. to Willows	8.3	low	low	60	8
23	Existing part of Hwy 162 west of Willows	8.7	low	low	60	9
24	Existing County Road 303 (half paved, half dirt) from Hwy 162 through Clark Valley to Sites Lodoga Rd.	20.9	moderate	moderate	40	31
25	Existing part of Hwy 162 and paved County Rd. 306 around Stony Gorge Reservoir to north of East Park Reservoir	24.8	low	low	60	25
26	Existing part of paved County Rd. 306 from north of East Park Res. to Lodoga	13.3	low	low	60	13
27	Existing dirt rd. from north of East Park Reservoir to Lodoga	9.8	moderate	moderate	40	15
28	Proposed road along southwest Sites Reservoir shoreline	17.0	moderate	high	20	51
29	Existing part of Sites Lodoga Rd.	1.7	moderate	moderate	40	3
101	Existing Maxwell Sites Rd. within and east of Sites Reservoir	5.3	low	moderate	40	8
102	Existing Sites Lodoga Rd. within and west of Sites Reservoir	3.5	moderate	low	55	4
103	Existing Huffmaster Rd. within Sites Reservoir	6.2	low	moderate	40	9

Notes: ¹ Low profile grade is less than 2 percent
Moderate profile grade is 2 percent to 4 percent
High profile grade is greater than 4 percent

² Driving speed starts at 60 mph, and is reduced by the following percentages:

Low profile grade - zero

Moderate profile grade - 10 percent

High profile grade - 20 percent

Low horizontal curvature - zero

Medium horizontal curvature - 30 percent

High horizontal curvature - 60 percent

Speed reductions are multiplied. For example, a road segment with medium profile grade and medium horizontal curvature would have a speed of [60 mph * (1 - 0.10) * (1 - 0.2)] = 45 mph (rounded to the nearest 5 mph)

**Table 3. Thomes-Newville Existing and Alternative Road Realignment Segments
(refer to Figure 2)**

Road Segment	Segment Description (Refer to Figure 2)	Segment Length (miles)	Average Profile Grade ¹	Average Horizontal Curvature	Driving Speed (mph) ²	Driving Time (minutes)
1	North - Existing Newville Road to Garland to Round Valley Road	8.5	moderate	moderate	40	13
2	South - Existing Newville to County Road 306	2.6	low	low	60	3
3	Northwest - Existing Round Valley Road	2.8	moderate	moderate	40	4
4	Proposed North - Newville Road to Round Valley Road	6.9	moderate	high	20	21
5	Proposed South - Newville Road to County Road 306	3.5	moderate	moderate	40	5
6	Proposed Northwest - Round Valley Road to Round Valley Road	2.2	moderate	moderate	40	3

Notes:

¹. Low profile grade is less than 2 percent
 Moderate profile grade is 2 percent to 4 percent
 High profile grade is greater than 4 percent

². Driving speed starts at 60 mph, and is reduced by the following percentages:

Low profile grade - zero
 Moderate profile grade - 10 percent
 High profile grade - 20 percent
 Low horizontal curvature - zero
 Medium horizontal curvature - 30 percent
 High horizontal curvature - 60 percent

Speed reductions are multiplied. For example, a road segment with medium profile grade and medium horizontal curvature would have a speed of
 $[60 \text{ mph} * (1 - 0.10) * (1 - 0.2)] = 45 \text{ mph}$ (rounded to the nearest 5 mph)

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Offstream Storage Investigation - Thomes-Newville Project **Profile of Existing North, South and West Alignments and Alternative Realignments** **March 9, 2000**

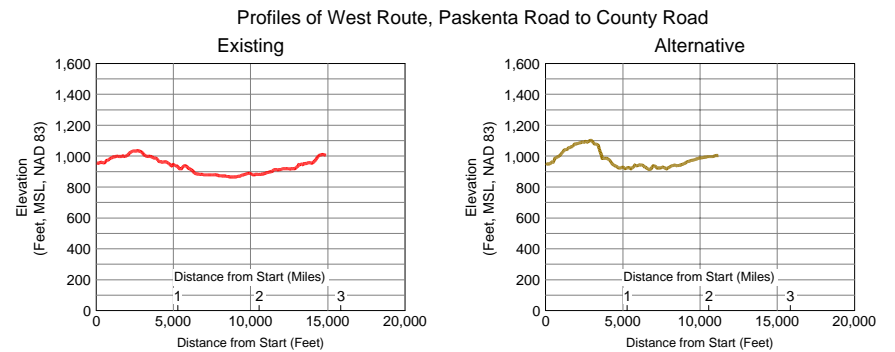
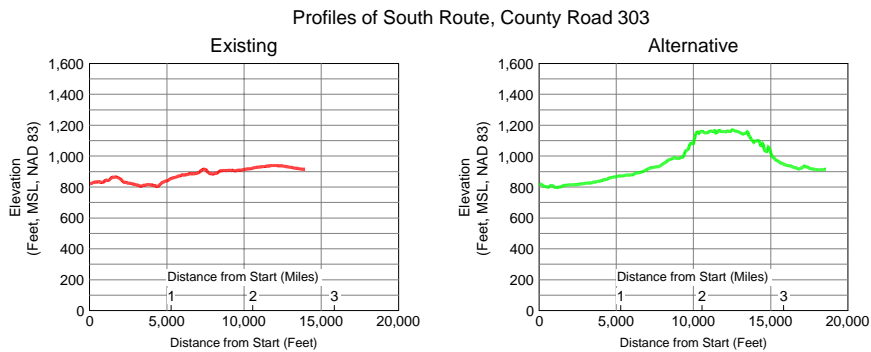
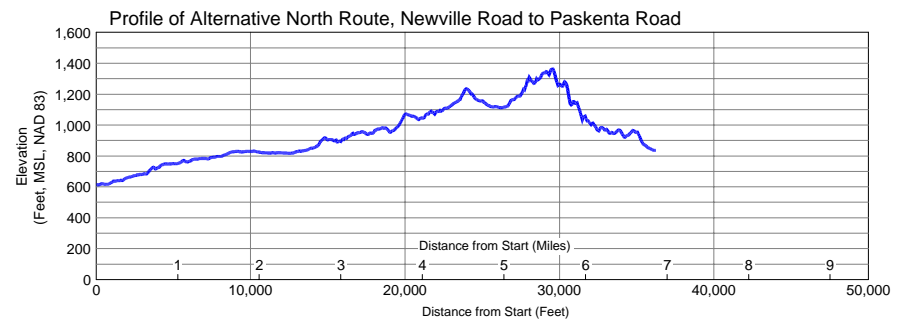
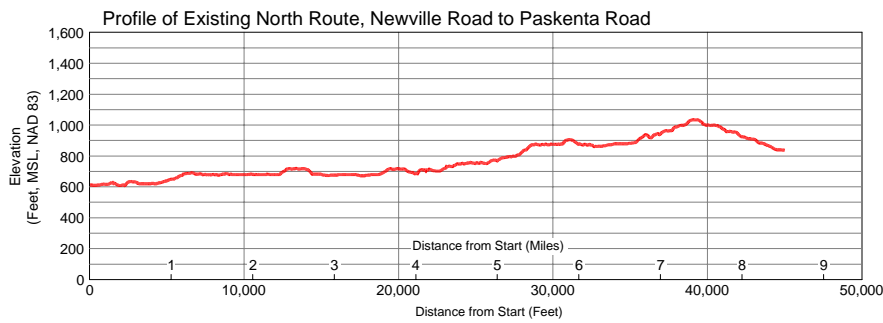


Figure 5

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Photos of Existing and Proposed Access Around Sites Reservoir



Photo 1. T-C Canal looking east



Photo 2. T-C Canal looking west to Sulphur Gap

Photos 1 and 2 show the east end of alternative alignments that would go south of Sites or Colusa Reservoirs. Photo 1 is taken from a bridge over the Tehama-Colusa Canal on Standard Road, looking east toward Maxwell. Photo 2 is taken from the same place, looking west toward Sulphur Gap.



Photo 3. Sulphur Gap, looking east



Photo 4. North of Sulphur Gap, to west

Photo 3 shows the Sacramento Valley as seen from Sulphur Gap. It shows the steep rise up to Sulphur Gap. Photo 4 is taken from north of Sulphur Gap, looking west into the potential Sites Reservoir area.



Photo 5. South Grapevine Creek Alignment



Photo 6. Windy Point, looking southeast

Photo 5 shows the south end of the Grapevine Creek alternative alignment. Photo 6 shows Leesville Road to the south, looking down from Windy Point. This photo illustrates the steepness of some of the terrain through which alternative road alignments must pass.



Photo 7. Leesville-Lodoga Road looking west



Photo 8. NW Sites Reservoir area

Photo 7 shows the Leesville-Lodoga Road, looking west at the community of Leesville. This valley road alignment has a flat slope, but it would have to be widened and improved in order to serve re-routed traffic from Maxwell. Photo 8 is taken from inside the northwest portion of the Sites Reservoir area, looking northwest. The northern alternative road alignment around Sites Reservoir (Black Line) would be about halfway up the slopes of the hills in the background of this photo.

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